EFFICACY OF CHINNPV FOR CONTROL OF SOYBEAN LOOPER, *CHRYSODEIXIS INCLUDENS,* IN ARKANSAS SOYBEAN PRODUCTION

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Abstract

Synthetic insecticides are the most common and reliable control method for soybean looper, *Chrysodeixis includens.* As resistance to synthetic insecticides increases in soybean looper, growers are seeking additional control options that are both cost-effective and efficacious. Multiple studies were conducted in 2020 at the University of Arkansas Lonoke Research and Extension Center to evaluate the efficacy of ChinNPV. In the first experiment, Chrysogen (ChinNPV) was applied at 2.5, 3.0, 3.5 and 4.0 oz/a to V3 soybean. After application, plants were infested with 3rd instar soybean looper larvae and mortality ratings were taken daily. At eight days after application (8 DAA) an average of 63% defoliation and 40% mortality was observed across all rates of ChinNPV compared to 98% defoliation with 0% mortality in the UTC.

Additionally, a diet-overlay assay was conducted using four ChinNPV rates equivalent to those used in the first experiment. Each rate was evaluated on neonate, 1st, 3rd,4th, 5th, 6th instar larvae. The desired rates of ChinNPV were combined into 200 mL of water, then 100 µL of the solution were applied directly to insect rearing diet in diet cups. After drying, a single larva of the desired instar was placed upon the diet and replicated 30 times. For neonate and 1st instar, 80% mortality was observed for all ChinNPV treatments at 6 and 8 DAA, respectively. In 3rd and 4th instar larvae 80% mortality was achieved only after 14 days with a ChinNPV rate of 3 oz/a or greater. At 14 DAA, 80% mortality of 5th instar larvae was observed in treatments of 2 ½ oz/a or greater and 2, 3, and 3 ½ oz/a in 6th instar. These results will help us determine the utility, recommended dosage, and control expectation for ChinNPV on soybean looper.

Introduction

Among row crops planted in Arkansas, soybean ranks first in terms of area planted, with a total of 2.82 million acres in 2020. Soybean looper (*Chrysodeixis includens*) is a major yield limiting pest in late season soybean production. In 2019, 1.72 million acres were infested, with 20% of those acres being treated. Infested acres resulted in a 9.3% of all total insect losses + costs. Acres infested with soybean looper averaged $5.05 in losses + costs with one insecticide application averaging $15.70. Increased resistance to synthetic insecticides has caused researchers to look for an alternative biological control method for soybean looper. The objective of this study was to determine if ChinNPV could be an effective and cost-efficient option for soybean looper control.

Materials and Methods

Rate Response Study:

A study was conducted at the University of Arkansas Lonoke Research and Extension Center using 3rd instar larvae obtained from MSU Insect Rearing Lab. The trial consisted of 5 treatments (UTC, 2 ½, 3, 3 ½, 4 oz/a) with 10 replications per treatment and one plant per replication. Applications of ChinNPV were made to V3 soybeans (Asgrow AG 46x6) using a backpack sprayer calibrated to 40 PSI at a speed of 3 MPH. Soybeans were maintained in greenhouse with settings of 90°F and 65% humidity. After ChinNPV applications, each replication was infested with three larvae. All treatments were evaluated daily up to 14 DAA for percent defoliation, mortality, and survival. Defoliation percentages were obtained by taking average level of defoliation between three trifoliates using LeafByte. Rating of mortality was conducted by daily observations.

Diet Overlay Study:

Six larval instars (Neonate, 1st, 3rd, 4th, 5th, 6th) were evaluated for timing of mortality when introduced to ChinNPV. Diet obtained from Southland Products Inc. consisting of a soy flour and wheat germ was constructed and filled the bottom ¼ inch of 1 oz diet cups. Rates of ChinNPV ranging from 2 oz/a to 4 oz/a increasing in half ounce increments consisted of 30 replications and stored in an insect incubator at 29.4 and 25.6 °C, with a light dark ratio of 14:10, at 80% humidity. ChinNPV and water was made into a 1:1 solution. Mix solution was added to 200 mL of water to obtain the desired rate. Rate solution was then added to diet cups at 100 µl. One soybean looper larvae was then introduced per diet cup after allowing solution to dry. Daily observations were conducted to evaluate percent mortality and survival.

Results

Rate Response Study:

No differences in defoliation were observed until 3 DAA for all ChinNPV rates (Figure 1). At 3 DAA defoliation averaged 25.9% in the untreated check (UTC) while defoliation in all rates of ChinNPV remained below 13.4%. At 6 DAA the UTC averaged 54.4% defoliation while ChinNPV treatments ranged from 48.5 to 67.9% defoliation (Figure 1). At 8 DAA, the UTC exceeded 90% defoliation, while ChinNPV treatments ranged from 55 to 71% defoliation. At 5 DAA, all rates exceeded 40% defoliation with less than 20% mortality. At 10 DAA, mortality in the ChinNPV treatments ranged from 65% for the 2.5 oz/a to 82% for the 3 oz/a rate (Figure 2).

Diet Overlay Study:

For all rates, neonate and 1st instar larvae reached 80% mortality between 4 and 7 DAA. For 2 oz diet overlay, 6th instar reached 80% mortality at 13 DAA while all other instars remained below 68% mortality. At 11 DAA in the 2.5 oz diet overlay, 5th instar reached 82% mortality. Remaining instars ranged from 48 to 77% mortality at 14 DAA. The 3 oz diet overlay at 9 DAA resulted in mortality ranging from 43 to 66% in remaining instars. At 12 DAA, all instars exceeded 80% mortality. Similar results were observed in the 3.5 oz diet overlay with larvae instars mortality ranging from 42 to 73% at 9 DAA. Instars 4th through 6th reached 80% mortality at 11 DAA while it took 3rd instar 13 days to reach 86% mortality. In the 4 oz/a diet overlay, 3rd instar larvae reached 82% 9DAA. At 11 DAA, 4th and 5th instar exceeded 80% mortality while 6th instar did not exceed 77% mortality within 14 DAA (Figure 3-7).

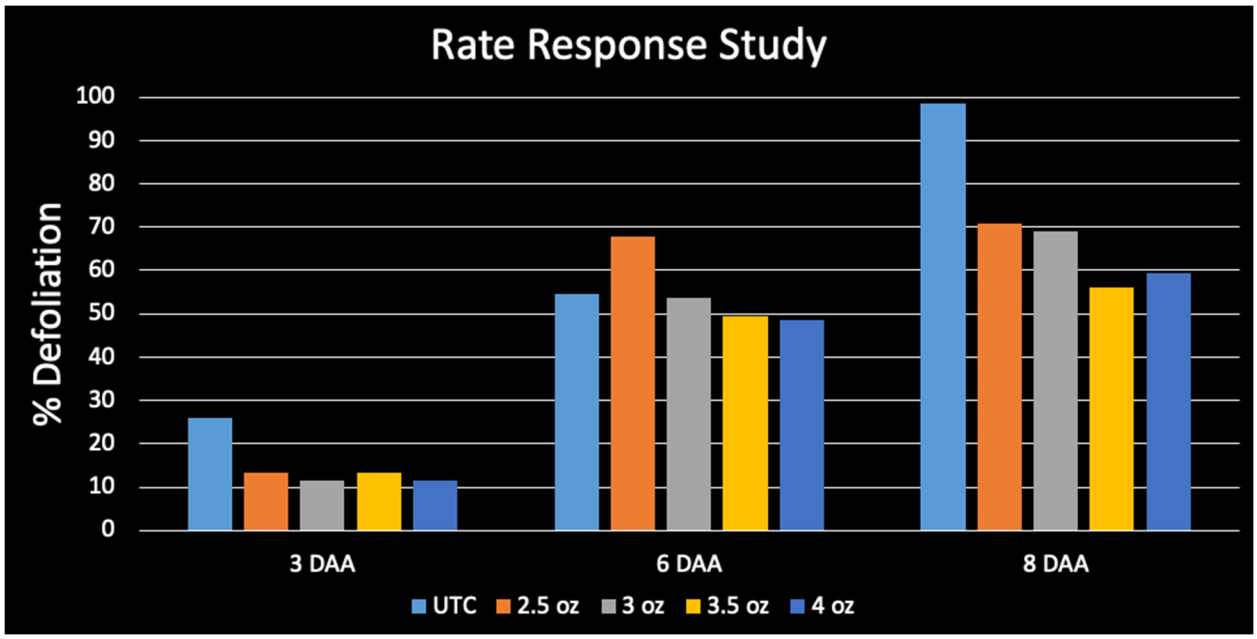

Figure 1: Defoliation percentages for Rate Response Study

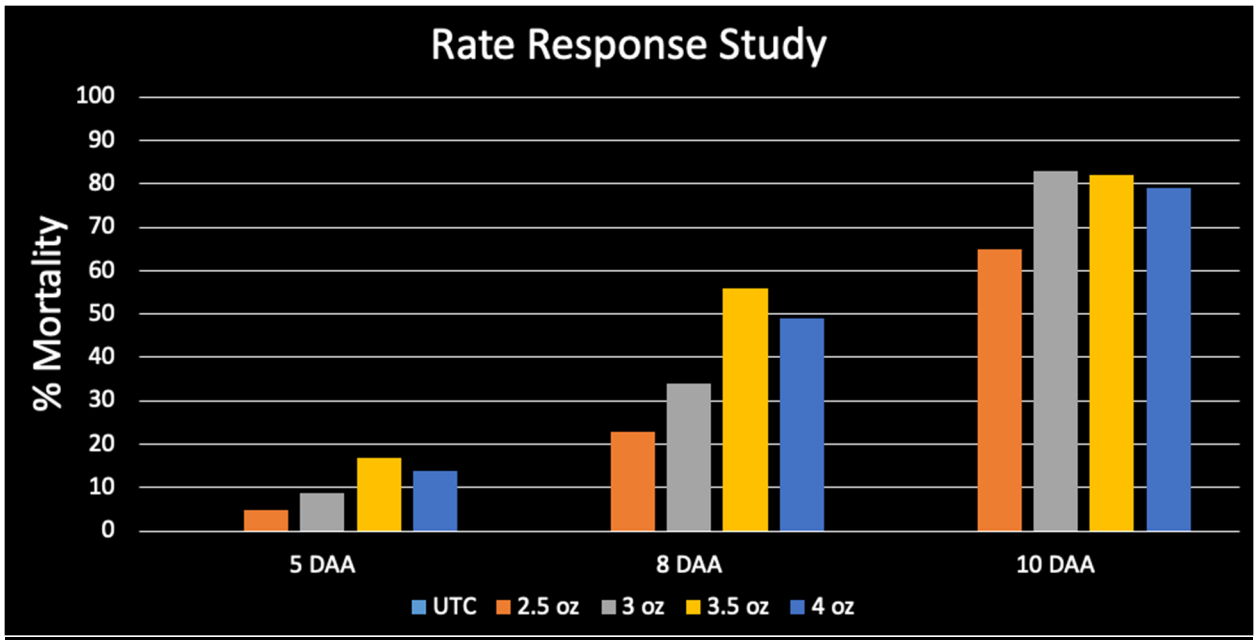

Figure 2. Rate Response Results for percent mortality

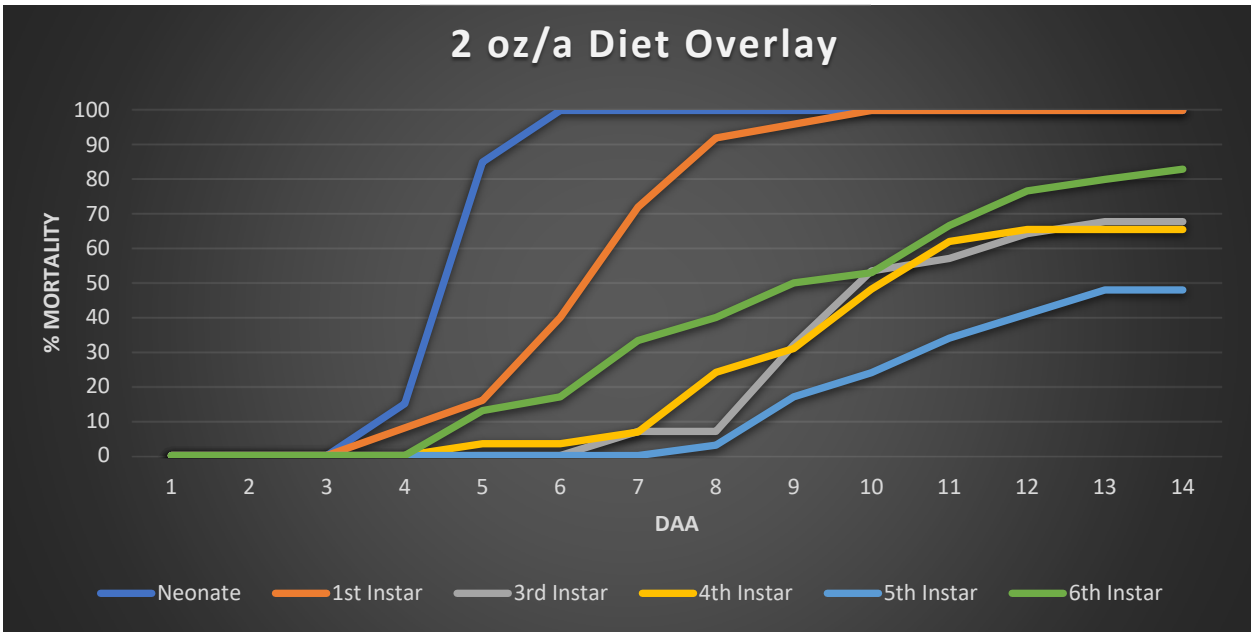

Figure 3. Diet Overlay results for 2 oz/a. Instars were analyzed for percent mortality up to 14 DAA

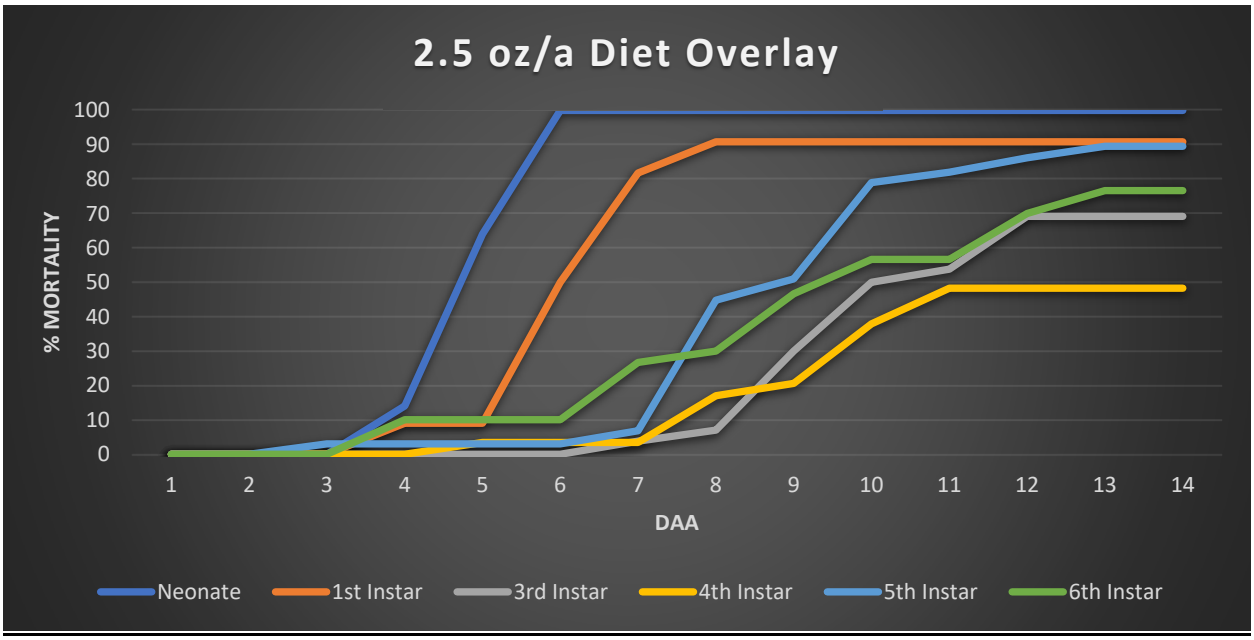

Figure 4. Diet Overlay results for 2.5 oz/a. Instars were analyzed for percent mortality up to 14 DAA

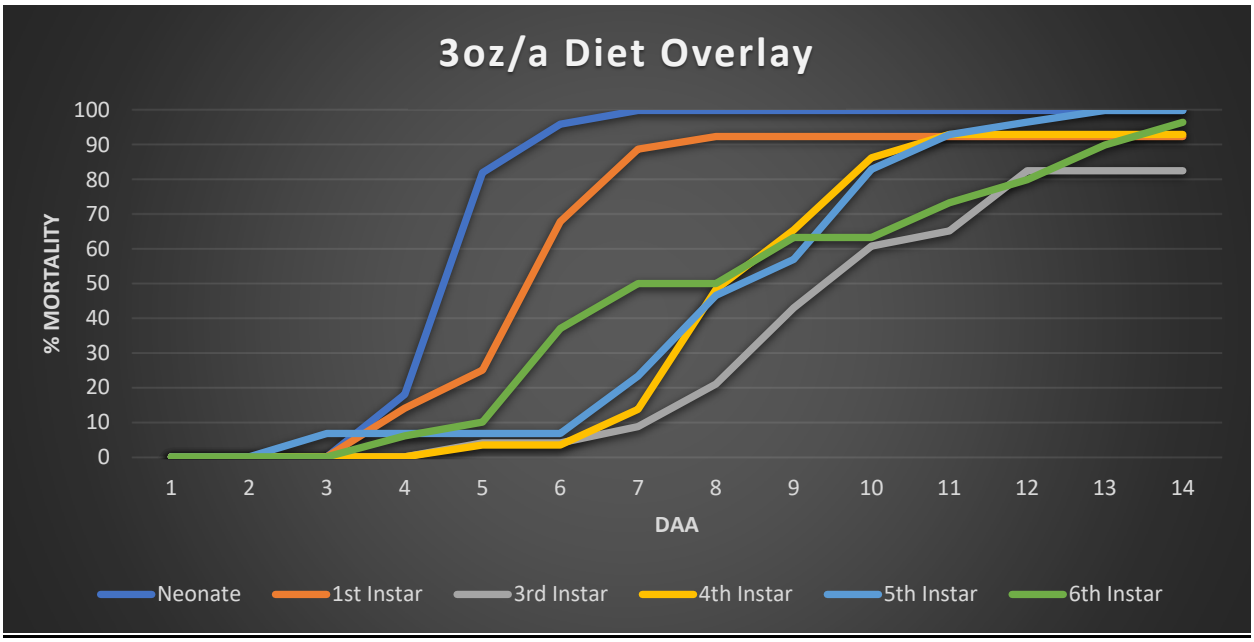

Figure 5. Diet Overlay results for 3 oz/a. Instars were analyzed for percent mortality up to 14 DAA

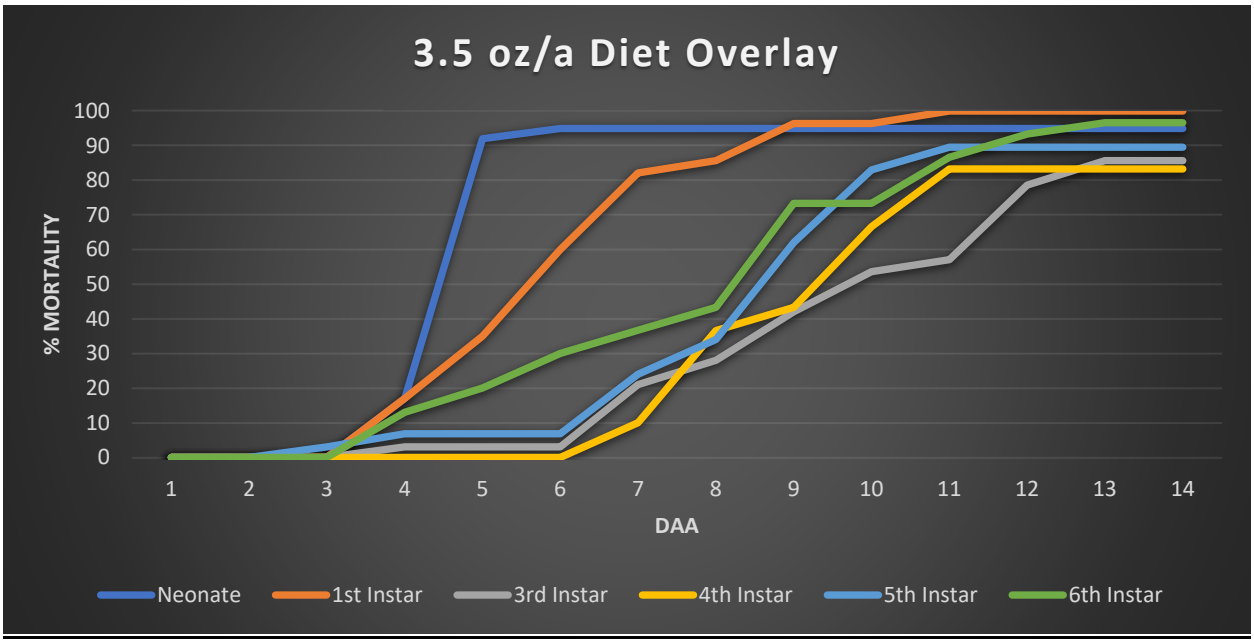

Figure 6. Diet Overlay results for 3.5 oz/a. Instars were analyzed for percent mortality up to 14 DAA

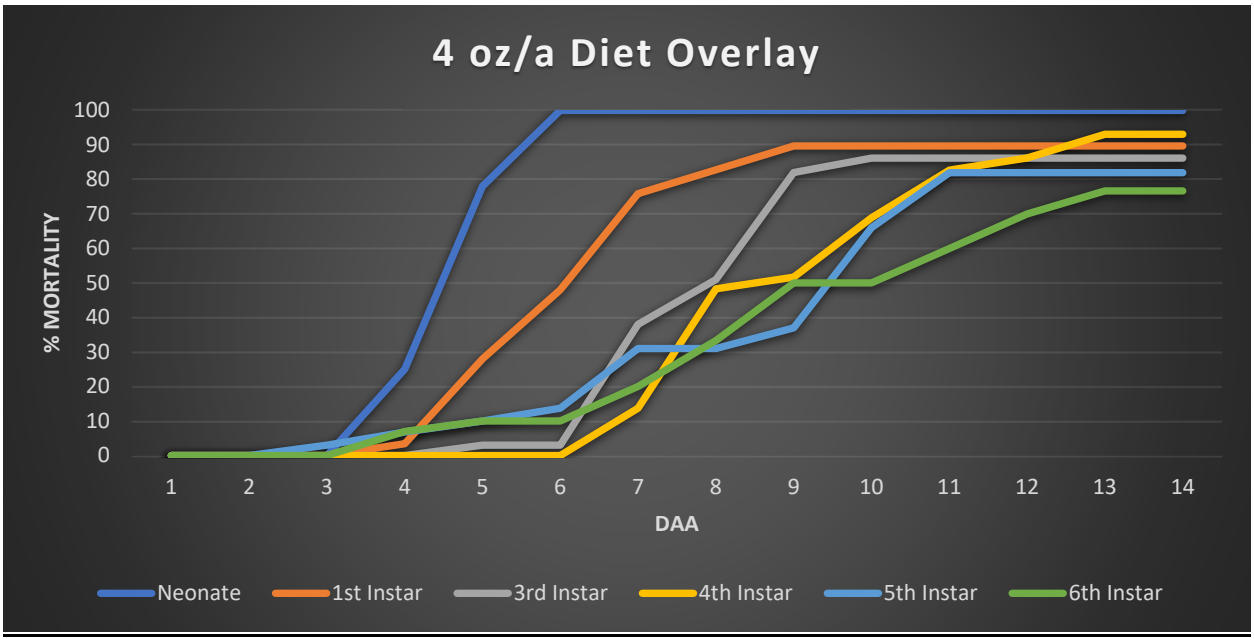

Figure 7. Diet Overlay results for 4 oz/a. Instars were analyzed for percent mortality up to 14 DAA

Summary

In the rate response study, it appears the virus did reduce defoliation somewhat, but this needs further analysis. Mortality in the rate response study was consistently greater than that in the UTC, but mortality was relatively slow, taking 10 DAA for any rate to achieve 80% mortality. In the diet overlay studies neonate, followed by 1st instar larvae, consistently reached 80% mortality quicker than all other instars. Time to death in later instars was variable in speed. There appeared to be no or very little rate response in speed or percent mortality in the diet overlay study.

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References

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